Composting at Longwood:

Past, Present, and Future…

- Where we've been
- Where we are
- Where we need to go

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- “The Worm Brings the Compost of the Bird”
- A metaphor for our story…

What Will Your Compost Be?

- Waste Disposal Alternative?
- Used by Agriculture?
- Mulch?
- Landscape Horticulture?
- Floricultural Media Alternative to Peat Moss?

View of Facility - Facing North

Abbondi Composting Facility

Getting Started in the Late 1980's:

- Compost pursued as an alternative to horticultural waste disposal
- Private consultant hired
- Equipment was purchased
- Minimal Facility
- Result was aging processes:
  - Leaf Mold
  - Mulch

Leaf Mold Compost: An "Aging" Process

Leaf Mold:

- Leaves collected from Gardens or Contractors in fall
- Pile turned "when needed"

- High pH (>7.5) due to leachate run-off loss
- Pile put through manure spreader once
- Ready for use by spring
- *Used to be our favorite!*

Current Longwood Compost Products:

- Leaf mold compost (Aging)
  - Flower and shrub beds, aesthetics
- Shredded hardwood mulch (Aging)
  - Shrub beds, paths
- "Fines" from shredded hardwood mulch
  - Compost charge
  - Organic amendment to soil fields
- Herbaceous compost (2:2:1)
  - "Overs" go to potting media
  - "Fines" will go to turf compost
  - Any immature material goes to charge pile or as organic fertilizer to topsoil

Shredded Hardwood Mulch

The Beginning: the “Brush Pile”

The Process…

- Tub ground to approx. 2 inch size
- ~½” screen used (‘unders’ become ‘fines’)
- Regrind with another set of screens in grinder
- This becomes our finished mulch
  - **<u>Tub Grinder Rental Costs approximately $15,000 2X/year</u>**
  - **<u>8,000 cubic yards to start = $160,000/year if hauled off site</u>**
  - *2,500 cubic yards finished mulch = $50,000/yr. if purchased*

Finished Product: Shredded Hardwood Mulch: Turned and aged for 6 months before use

Fines

Longwood Compost Production:

- Windrows layed out with feedstocks
- Feedstocks monitored for quality
- Temperature and Oxygen monitored frequently
- Compost is turned at critical intervals
- Entire process takes 8-12 wks.
- Turning adds O_2!
- New recipes being worked on

Longwood Compost Specs

- Starting C:N ratio of 35
- Peak temperature - >145 degrees F = turn
- Oxygen – < 5% = turn
- CO_2 - < 8%
- Moisture – 40-65%
- Various particle sizes present in the pile
- Final screening <1/2”

Sandberger Turner

The three most important rules…

- CONSISTENCY, CONSISTENCY, CONSISTENCY!

- Control Physical Attributes/Particle Size
- Predictable Chemistry
- Quality Biology Every Time

- NO MISTAKES ALLOWED

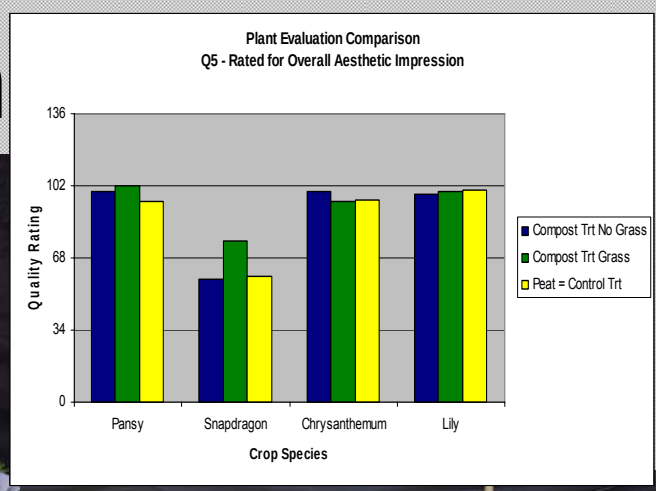








Effects of Compost Amended Container Media on Ornamental Plant Growth



Mark Highland - 2004
Longwood Graduate Program
University of Delaware

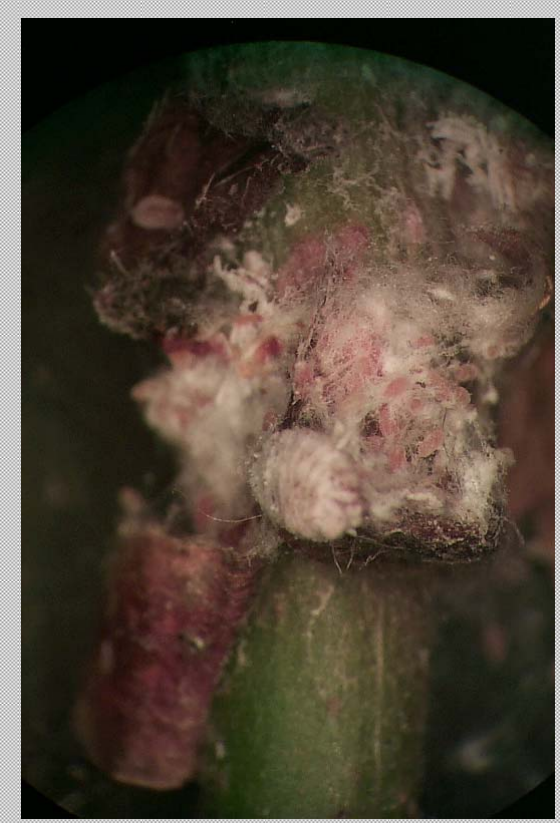
On-Farm Composting Permit:

- **Process began: 2004**
- **Permit obtained: 2006**
- **Allows for expansion into food waste and other waste stream composting**
  - **Current Permit Limits: (per year)**
    - **Mulch/Compost Products: 3,000 cu. yards/ac. (incl. finished material)**
    - **Food Waste Compost: 1000 cu. yards**

Compost and Insect Resistance:

- When compost replaces peat moss in potting media, do mealybug and mealybug destroyer populations also change?

- When compost tea is used, what are its effects on mealybug populations and "plant quality"



Longwood Waste Stream - Future Directions:

- Source Separation Recycling
  - Currently: Cardboard, Office Paper, and Restaurant Co-Mingle (#1 and #2 Plastic Only)
  - Future: Separated Plastics
    - Horticultural (Pots, Films, Bags)
    - Restaurant
- Biodiesel use in applicable fleet vehicles
  - Increased fleet fuel efficiency
- Biomass to Energy Facilities
  - Crops grown on-site
- Solar Power Technology

Longwood Gardens

Transforming Organic Waste Management in PA – Spring 2007 Group
Leibnitz, Austria – 12 June 2007

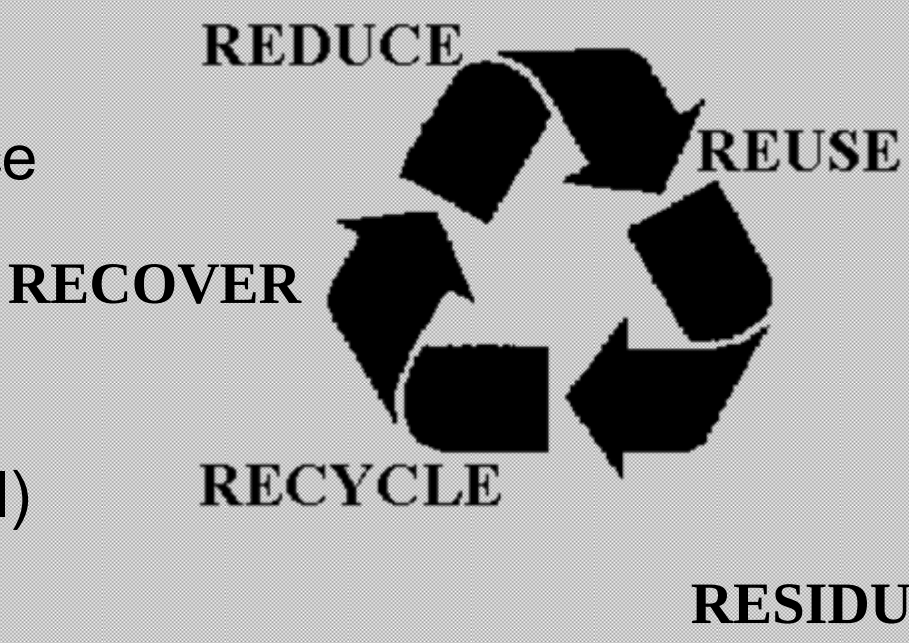
Compost EU Tours: 2006-2007:

- The “Players”: 30 Members from Academia, Municipal and State Government, and Industry
- Funding: USDA-ARS International Studies and PA Agricultural Stimulation Grants
- Our Vision – “Articulate a new vision for organic waste management in PA that reconnects municipal and agricultural sectors in mutually beneficial and sustainable flows of energy, organic matter, nutrients, and capital; and disseminate this vision to a wide audience.”

Waste Management – Germany/Austria:

- These countries have achieved 95% organic waste diversion by banning all forms of organic waste from landfills – thus shifting them to energy recovery modes

- Their Model:
  - Reduction/Avoidance
  - Reuse
  - Recycle
  - Energy Recovery
  - Landfilling (Residual)



Moving away from a “waste disposal” mentality to “resource recovery” mode


Straße der Holzenergie
Mureck: Wärme aus Holz als erster Schritt zur autarken Bioenergieversorgung
Die große Vision einer kleinen Gemeinde:
Wirtschaftliche und technische Daten:
Kesselanlage
Information über die Gemeinde
Brennstoffversorgung
Besichtigung, Kontakt
Nahwärme Mureck Ges.m.b.H.
Rohrfirma:
Kesselfirma: Kohlbach
LandesEnergieVerein Steiermark


Biodiesel
SEEG BIODIESEL
1L BIODIESEL erspart 2,3kg CO2


SEEG
1990
BÄUERLICHES RAPS-PROJEKT
ÜDSTEIRISCHE ENERGIE UND
IWEISSERZEUGUNG.REG.GEN.M.B.H


ÖKO-Diesel
Biodiesel
WELTWEIT
DIE ERSTE
MAI 1994


8
Energie·Schau·Straße
Rasen-Folie
Die Form gibt der Funktion die Farbe!
Wie erschafft man etwas Unvergessliches und lässt trotzdem einfach Gras darüber wachsen?
An allen 5 Seiten mit Gras bewachsen, hebt sich der „Würfel" nur räumlich von seiner Umgebung ab. Die Installation spielt mit den stereotypen Sehgewohnheiten des Menschen und der unterbewussten Zuordnung von Oberflächen und Texturen an bestimmte Objekte und räumliche Ebenen.
Die Vegetation erobert an den Fassaden die Lotrechte als ultimativen Extremstandort. Nur hoch spezialisierte Pflanzen, wie die verwendeten Hauswurz- und Fetthennenarten, sind in der Lage, unter diesen Bedingungen langfristig zu überleben. Ein gut wasserspeicherndes, speziell für solche Zwecke entwickeltes Bodensubstrat sowie eine gezielte computergesteuerte Bewässerung und hinter den Vegetationsmatten verlegte Schwitzschläuche sollen ganzjährig das Bild grüner Wände gewährleisten.
Das Rasen-Folie kann unterschiedlichste Themen aufgreifen und so auch bei Veranstaltungen genutzt werden.
Energie·Schau·Straße

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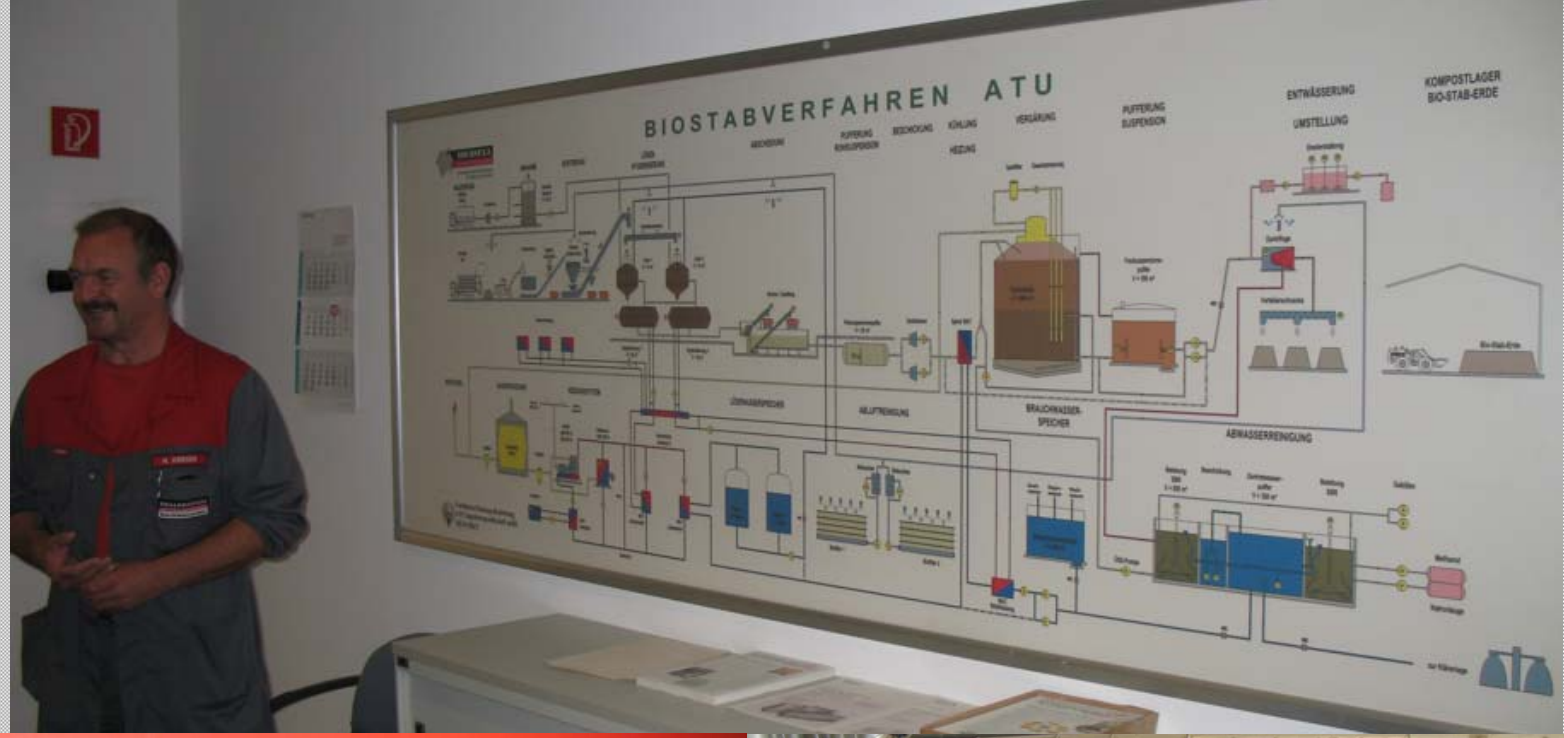
LEONARDO HOUSE
BIOGAS FACILITY
EXCAVATION PAVILION
ECOLOGICAL RACING TRACK
NATURE TRAIL

What Role Can Public Gardens Play?

- Education:
  - Environmental Education (Soil, Air, Water - in addition to Plants)
  - Backyard Composting, Compost Value, Biodiesel, etc., etc.
- Demonstration:
  - Recycling
  - Alternative Energy
- Partnerships:
  - State and Municipal Government, Industry


BIOSTABVERFAHREN ATU
ENTWÄSSERUNG
UMSTELLUNG
KOMPOSTLAGER
BIO-STAB-ERDE
ABWASSERREINIGUNG

Particle Sizes in the Trade:

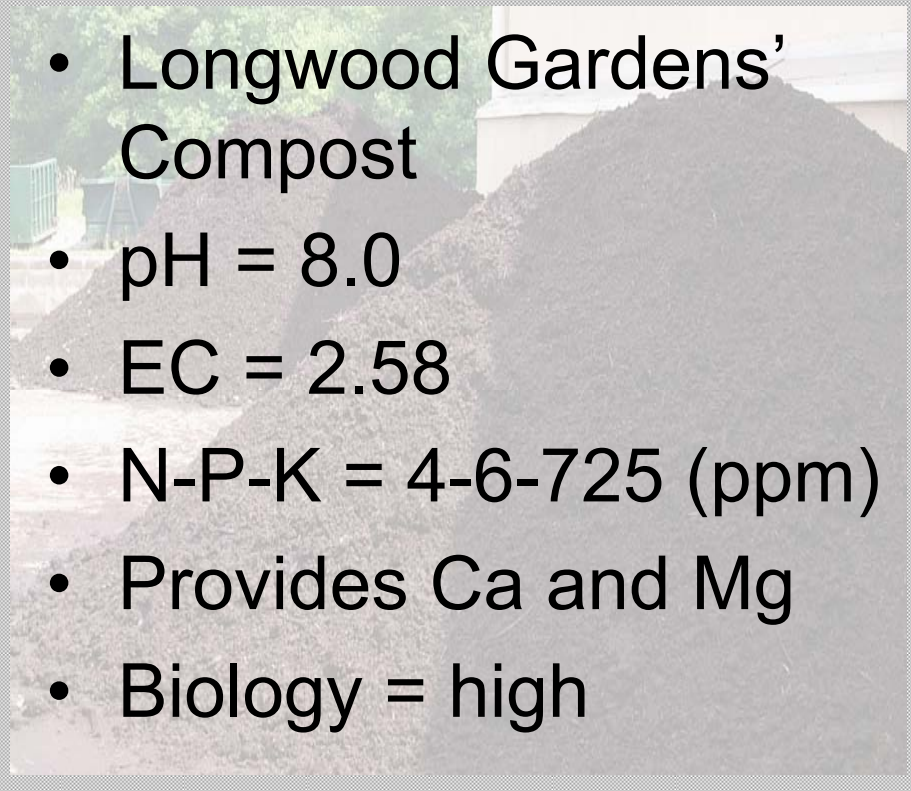
- 1/8 – 1/4 inch:
  Turf topdressing
- < 1/2 inch:
  Topdressing for flower and shrub beds
- 3/8-3/4 inch: or < 3/4 inch:
  Ideal for container nursery production and greenhouse use (bark or compost)
- 3/4 inch – 1 1/2 inches:
  Mulch for shrub and flower beds
- > 1 1/2 inches:
  Not desirable

What makes good compost for use in container media?

- Physical Properties
  - Particle size ≤ ¾” with diversity of sizes
- Chemical Properties
  - pH = 6.5-8.0
  - EC ≤ 3 mmhos/cm
  - C:N ≤ 20
  - Solvita™ ≥ 7
- Biological Properties
  - Compost Food Web

Peat vs. Compost:

- Canadian Sphagnum Peat
- pH = 3.4
- EC = 0.12
- N-P-K = 5-1-1(ppm)
- No Ca or Mg
- Biology = low



- Longwood Gardens' Compost
- pH = 8.0
- EC = 2.58
- N-P-K = 4-6-725 (ppm)
- Provides Ca and Mg
- Biology = high

- Currently, 70 yds^3 peat used annually at Longwood Gardens
- Globally, in 1998, over 32,000,000 yds^3 peat used by horticulture industry*

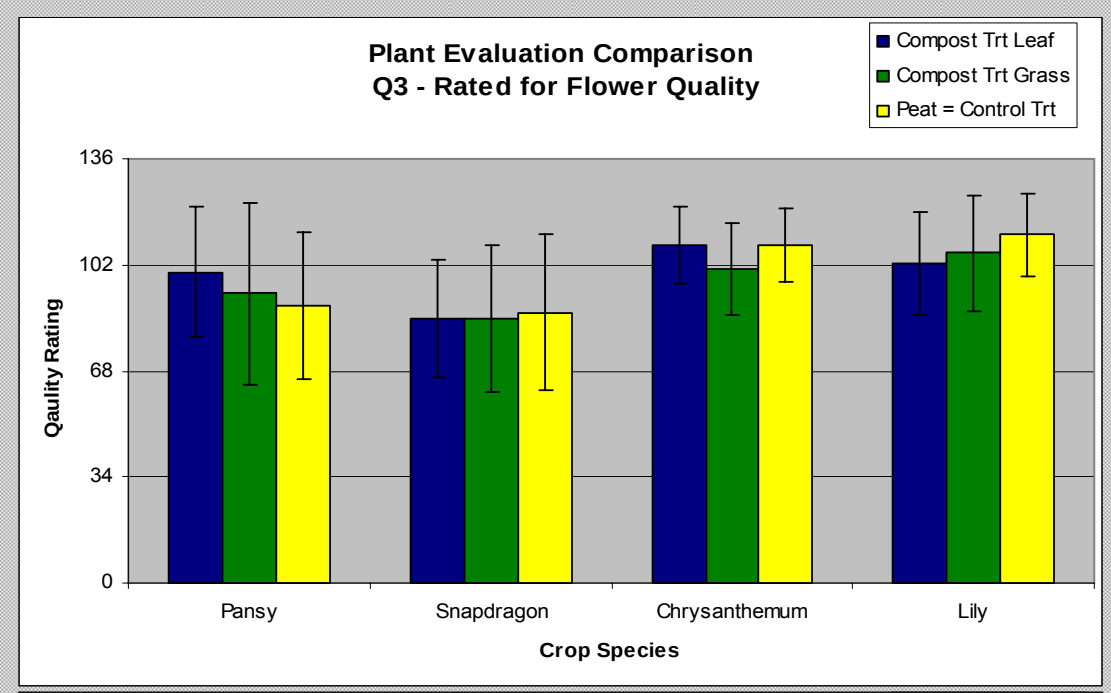
* Peat Harvesting and the Environment, Canadian Peat Producers Association

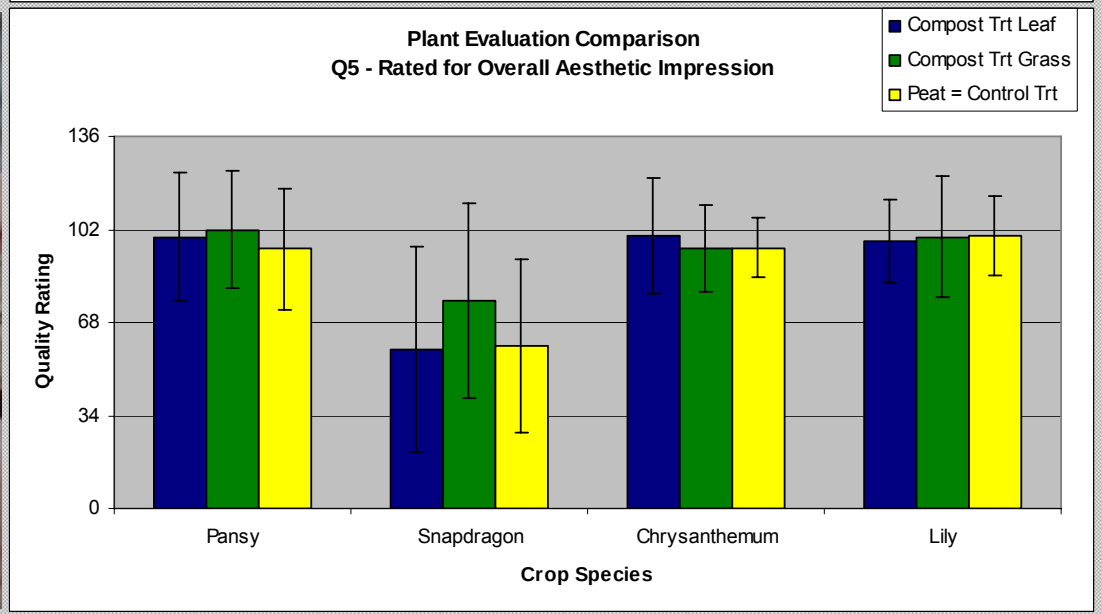
Three Major Treatment Comparisons

Order: (L-R) Leaf (Compost), Grass (Compost), Peat

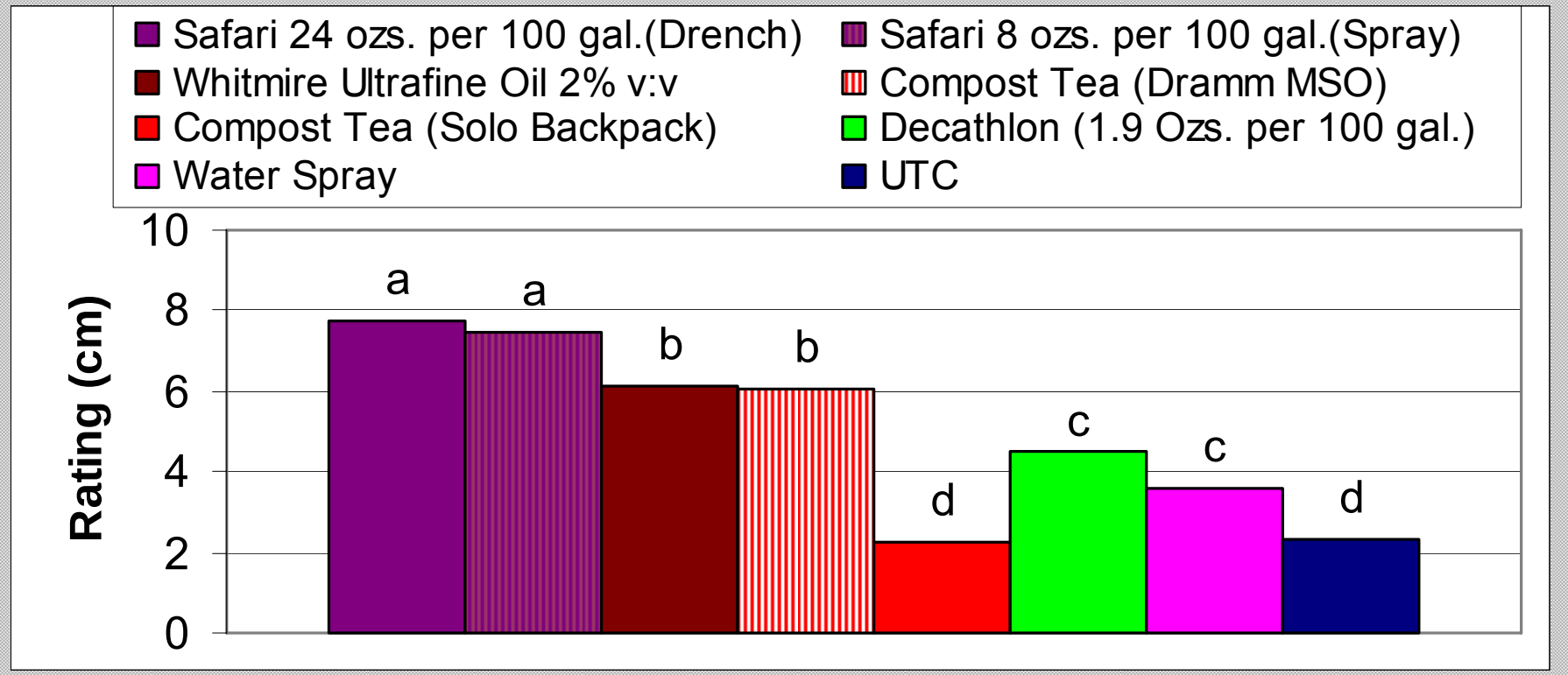
Plant Evaluation Results

- *No significant differences observed for four crops when grown in compost as opposed to peat moss*





Compost Tea Methods Trial Results - Aesthetic Ratings



Means grouped with the same letter are not significantly different by FLSD (p=0.05). Sprays at 10/7 and 10/24.

RCB Design; N=6 replications: *P. madierensis* on *S.s.* 'Mr. Wonderful'

Materials Tracking:

- *Up to 2004:*
  LWGD mulch
  use was minimal
  (bought instead)
- *2005:*
  1222 yds. mulch+
  122+ yds. bought
- *2006:*
  2500 yds. mulch
  capacity

Current Outputs:

- Hardwood Mulch – 2500 cu. yd.
- Leaf Mold – 1000 cu. yd.
- Tub Ground “Fines” – 1000 cu. yd.
- Compost – 800 cu. yd.

Estimated Outputs:

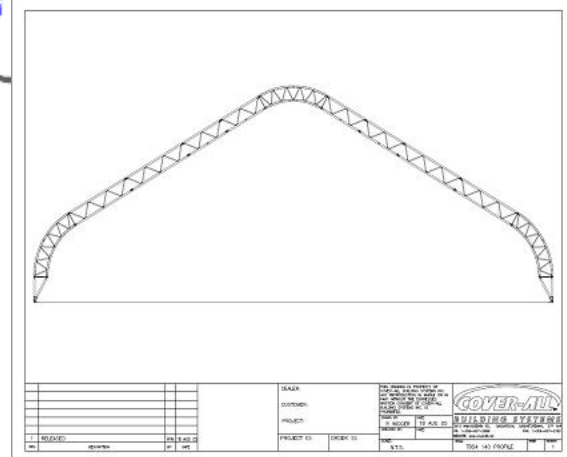
- Hardwood Mulch – ~2500 cu. yd. (currently fall short of material requested)
- Leaf Mold – ~500 cu. yd. (divert any excess to compost blends and to sites where increased pH necessary)
- Tub Ground “Fines” – ~1000 cu. yd. (charge pile biology, soil fields)
- Compost – >3500 cu. yd. (used in garden beds, turf, potting media, nursery beds, soil fields, and compost tea)

Composting Facility Enhancement:

- Upgrade Composting Pads
  - Prevent soil from reducing compost quality
  - Protect finished product from excess moisture
  - Prevent offsite runoff

Compost Pad Project:

- **Provides covered space and impervious surface to finish/store materials**
- **Size based on 2 large windrows and space/site/cost considerations**
- **Test pad of less expensive materials failed**



Equipment Upgrades:

- Equipment Upgrades
  - Screener (FY 2005)
  - Turner (FY 2006)
  - Food Waste Transfer (Not Spec'd)

Composting Program Goals:

- Upgrade facilities and equipment
- Expand compost stream
- Diversify compost use

View of Facility - Facing North

Zwickey's Tub Grinder (Morbark)

Screens on grinder

‘Overs’ = 1 more grind

- Tub ground mix is passed through Trommel with ½” screen
- Fines = utilized as compost feedstock/charge

Compost Contains…

- Heterotrophic Bacteria (Aerobic)
- Actinomycetes
- Anaerobic Bacteria (including facultative anaerobes)
- Pseudomonads
- Nitrogen-Fixing Bacteria (Free living)
- Yeasts and Molds (Fungi)
- Mycorrhizae?
- Plus plant active chemicals such as phytoalexins and auxin precursors to assist growth

Principle Soil Decomposers

Microbial Group	*Soil population (cells/gram soil)*
Bacteria	300,000 - 200,000,000
Actinomycetes	100,000 - 100,000,000
Fungi	20,000 - 1,000,000
Protozoa	10,000 - 100,000
Algae	100 - 50,000

(Courtesy NE SARE)

Future Directions in Sustainable Waste Mgnmnt:

- Source Separation Recycling
  - Currently: Cardboard, Office Paper, and Restaurant Co-Mingle (#1 and #2 Plastic Only)
  - Future: Separated Plastics
    - Horticultural (Pots, Films, Bags)
    - Restaurant
- Anaerobic Digestion
- Wood Chip Boilers – Sterling Motors
- GORE Covered Compost Systems
- Solar Power Technology
- Absolute Recovery of Source Separated Materials


GRÜNABFÄLLE
Problemstoffe
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